Genetic epidemiological parameter of mother and neonate and their correlation with pregnancy outcome and congenital defects

By

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A Dissertation submitted to the Department of Animal Sciences, Quaid-i-Azam University, Islamabad, in partial fulfillment of the requirements for the degree of

Master of Philosophy

In

Human Genetics

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In the name of ALLAH, the Most Beneficent, the Most Merciful

All the praises and thanks be to Allah, the Lord of the Alameen (mankind's, jins and all that exists). The most Beneficent, the Most Merciful. The Only Owner (and the Only Ruling Judge) of the day of Recompense. You (alone) we worship and you (alone) we ask for help (for each and everything). Guide us to the straightway. The way of those on whom you have bestowed your grace, not (the way) of those who earned your anger, not of those who went astray (Fatiha).

Dedicated to my Respected Supervisor
Dr.Sajid Malik, my dear
Parents for their endless support, love,
and encouragement, my Brother,
Sisters, and Friends

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Raheela Asghar

Declaration

I hereby declare that I had worked on my Thesis “Genetic epidemiological parameter of mother and neonate and their correlation with pregnancy outcome and congenital defects.’’ independently and work presented here is original, and have not been submitted in current or any other form to any other university.

Raheela Asghar

Islamabad, 2012

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Abbreviations

APGAR	Appearance, Pulse, Grimace, Activity, Respiration
CI	Confidence Interval
CM	Congenital Malformations
CNS	Central Nervous System
CVD	Cardiovascular Defect
GA	Gestational Age
GIT	Gastro Intestinal Tract
Hb	Hemoglobin
ICD	International Classification of Disease
IUD	Intra Uterine Death
LFTs	Liver function test
MIM	Maternal and Infant Mortality
MNCH	Maternal Neonatal and Child Health
NHSP	National Health Survey of Pakistan
NMR	Neonatal Mortality Rate
NTD	Neural Tube Defect
OFC	Occipital-Frontal-Circumference
OMIM	Online Mendelian Inheritance in Man
PDHS	Pakistan Demographic and Health Survey
PIH	Pregnancy Induced Hypertension
PIMS	Pakistan Institute of Medical Sciences
PMRC	Pakistan Medical Research Council
PT	Preterm
RFTs	Renal function test
SD	Standard Deviation
WHO	World Health Organization

Introduction

1 Introduction

Maternal and child health has globally been of great concern since long time. In medical terms maternal health is exclusively understood as pregnancy related health. Despite the positive global trend in health development, progress had been slow or non-existence in low income countries. An estimated 600,000 women die each year, one per minute due to complications related to pregnancy and childbirth. About 98% of these are belonging to low income countries (Ahmad, 1999). Prenatal and neonatal mortality have been associated with maternal biological characteristics and complications during childbirth and pregnancy and efforts to improve the health of either pregnant women or new born have synergistic effects on the health of the other (Bergstrom 1994b, Walsh et al., 1994). Maternal mortality, morbidity for selected illness and nutritional status during pregnancy are the indicators of maternal health in low income countries (Koblinsky et al., 1993; Merchant and Kurz, 1993; Bergstrom, 1994a).

There are number of parameters which are sensitive predictor of maternal and child health. They have been explained and their status in Pakistan has been described below.

1.1 Maternal and neonatal mortality

Four million neonatal deaths and 500,000 maternal deaths occurs worldwide each year (AbouZahr et al., 2004). WHO estimated maternal mortality in Pakistan as 3.5 per 1,000 live births in 1995. In Pakistan more than 89% deliveries and 80% maternal deaths occurs at home and 80% deliveries had been attended by traditional birth attendants (PMRC,

1998; Anonymous, 1994) mortality is estimated to be 82 per 1,000 live births (PDHS, 1991). The death or chronic-ill health of mother increases the probability of death and poor growth and development of her child (WHO, 2005).

1.2 Preterm births (PT) and increasing mortality rate

Preterm birth is defined as delivery of the fetus at <37 weeks of gestation (WHO, 1993). Despite being well studied, little progress has been made towards understanding the etiology of PT birth (Buekens and Klebnoff, 2001; Goldeberg and Rouse, 1998; Iams, 1998; Slattery and Morrison, 2002). Approximately 75-80% of prenatal death occur in fetuses of gestational age (GA) <37 weeks (Goldenberg and Jobe, 2001), of these 40 % belongs to GA <32 weeks (Slattery and Morrison, 2002). Prematurity is a major factor contributing to the increasing mortality rate in developing countries (Ezechukwu et al., 2004; Fetuga et al., 2007). Factors that influence the success in the management of prematurity include sex, GA, availability of resources, level of prenatal care and adequate and well trained personnel (Baron et al., 1999).

1.3 Neonatal mortality rate (NMR)

Neonatal mortality rate (NMR) is defined as "the ratio of neonatal deaths in a given year to the total number of live births in the same year, expressed as ratio per thousand" (Hogarth, 1978). The risks of neonatal mortality and morbidity, particularly those reflecting inadequate adaptation to the extra uterine environment, largely depends on gestational age and birth weight (Doctor et al., 2001). Low birth weight deliveries and prematurity have been contributing significantly to neonatal mortality in developing countries due to lack of facilities (Amber et al., 2007; Najokanma and Olenrewaju, 1995).

Of two third world's neonatal death occurring just in ten countries, mostly in Asia, Pakistan rank number third among these countries. Pakistan accounts for 7% of global neonatal death, with 298,000 neonatal deaths annually and reported neonatal mortality rate 49 per 1,000 live births (Bhutta, 2004; Jalil, 2004; WHO, 2006).

1.4 Pregnancy induced hypertension (PIH), a cause of maternal and neonatal mortality and morbidity

Pre-eclampsia is a multi-system disorder that effects the fetus due to utero-placental insufficiency (Sibai, 2005). Mothers were diagnosed as having PIH when their BP was >140/90 mmHg, with protein content in their urine. Chronic hypertension was defined as the diastolic BP reading of 90 mmHg or above at first or booking visit before the 20^{th} week of gestation, or essential hypertension require medication, currently or previously. Proteinuria is defined as excretion of 300mg protein or more over 24 h or 2 readings of 2+ or more on dipstick analysis of midstream urine (MSU) catheter specimen of urine (CSU).

Complications in the mother include abruption, eclampsia, oliguria, anuria, dimness of vision and HELLP syndrome (Hemolysis, Elevated Liver enzymes and Low Platelet counts) (Padden, 1999). Intrauterine deaths, intrauterine growth restriction, prematurity and asphyxia are major complications in neonates. Pre-eclampsia is estimated to effect 8,370,000 women worldwide each year. Pre-eclampsia not only effects pregnancy outcome, but also predisposes mother and child to long term complications such as cardiovascular diseases (Bellamy et al., 2007).

In Pakistan maternal mortality rate is high and one in 89 women dies due to maternal causes of which eclampsia and pre-eclampsia are major causes (PDHS, 1991). Gestational

diabetes has significant association with an increased risk of preeclampsia and an even minor degree of glucose intolerance has been shown to be associated with preeclampsia (Drobny, 2009; Sun et al., 2008; Barden et al., 2004). Depression and anxiety in early pregnancy has been associated with risk for preeclampsia, a risk increase further if associated with vaginosis (Kurki et al., 2000). Family history of chronic hypertension has been considered as substitute measure for hereditary factors as well as common environmental or behavioral exposures that may cause preeclampsia risk (Mahomed et al., 1998; Merviel et al., 2008).

1.5 Congenital malformations (CM): prevalence and etiology

CM has been defined as morphological change that appears in prenatal period because of genetic mutations, chromosomal aberrations and adverse intrauterine environment. CM can be defined as an irreversible condition present in a child before birth in which there is sufficient deviation in usual number, size, shape, location, or inherent character of any part, organ, or cell constituent (Hudgin et al., 2006; Ali et al., 2008). A congenital physical anomaly is abnormality of structure of any body part that can be present at birth or shown later in life. Fetal problems range from minor abnormalities to major structural defects (Puri and Diana, 2003). Minor anomalies involve non-vital organ with little or no functional effects. Major anomalies impair function, can be life threatening, require immediate correction, and impair child development. Etiology of malformations can be genetic (multifactorial, single gene or chromosomal), environmental factors and teratogenic agent (maternal conditions: alcoholism, diabetes, endocrinopathy PKU, nutritional deficiency), infections, drugs, hyperthermia and unknown. About 66% of major

malformations have no etiology and majority of them are of multifactorial inheritance (Hudgins et al., 2006; Harris et al., 1997; Botto et al., 2001). Worldwide prevalence of CM is approximately 3-7%, but actual number varies from country to country (Park, 2005). Birth defects have association with adverse pregnancy outcomes, such as perinatal mortality, preeclampsia, preterm delivery, breech presentation, growth restriction, placental abruption and also distorted sex ratios (De Galan-Roosen AE et al., 1998; Larry and Paulozzi, 2001; Rittler et al., 2004; Chong et al., 2006).

1.6 Intrauterine deaths (IUDs): causes and prevalence

IUDs have been defined as an infant born after enrolment in which there is no sign of life (breathing, heartbeat, crying) is evident. Stillbirth is one of the most common adverse outcome of pregnancy. Approximately 3.3 million stillbirths are reported each year with 97% occurring in developing countries (Lawn et al., 2004). Rate of stillbirth is largest in South Asia ranging from 25 to 40/1,000 births. WHO reports Pakistani stillbirth rate of 22 per 1,000 births (WHO, 2006). Factors related to high stillbirth rates in developing countries includes infections, sepsis, malaria, birth injury, eclampsia/ pre-eclampsia, previous stillbirth and CM (McClure et al., 2006).

In Pakistan, other studies have shown that stillbirth rates vary from 36 per 1,000 to 70 per 1,000 in some rural areas (Lawn et al. 2005; Jokhio et al., 2005; Fikree et al., 2002). Reason behind such difference among reports is that the lower limit of the gestational age or birth weight varies widely. Most of the developed countries use 20 weeks as the lower gestational age cutoff for stillbirth, but some developed countries (such as Sweden) still use

28 weeks as the lower cutoff. In developing countries, the most commonly used cutoffs are 28 weeks or 1,000 gm (McClure et al., 2006; Goldenberg et al., 2004).

1.7 Consanguinity: types and effects

Consanguinity was defined as marriages between biological relatives and was classified as first cousin, first cousin once removed, second cousin and so on. Term inbreeding refers to the effect of consanguineous marriage in the grandparents as well as parental generations and is classified as non-consanguineous and non-inbred, non-consanguineous and inbred, consanguineous and non-inbred and consanguineous and inbred (Hussain, 1998). Inbreeding increases the probability for deleterious recessive genes to unite. Studies have shown that there is elevated level of CM (9.1-12.3%) among the offspring of consanguineous as compared to non-consanguineous marriages (1.0-5.3%) (Guz et al.,1989; Centerwall et al., 1966).

The recent Pakistan Demographic and Health Survey (PDHS, 2008) showed that 63% of all marriages were consanguineous unions and 80% of the consanguineous marriages were first-cousin unions (Sathar and Ahmad, 1992). Pakistan has highest rate of consanguineous marriages throughout the world. More than half of all marriages (61%) were between first and second cousins. First-cousin marriages on father side were more common (32%), first cousins on the mother's side were 21%. Eight percent of marriages were between second cousins, 7% were between other relatives, and one-third was between non-relatives. There is some evidence that shows that cousin marriage may affect both fertility and the health of children. First-cousin marriages in rural areas were 57% and 40% in urban areas. In Sindh, proportion of first cousin marriages was 56%, in Punjab 53%. Baluchistan 52%, and KPK 43% (PDHS, 2008).

1.8 Maternal, neonatal and child health (MNCH) in Pakistan

Pakistan has a population of approximately 172.8 million (WPDS, 2006). The National MNCH Programme aims at reducing the maternal mortality ratio to 2 per 1,000 live births and neonatal mortality rate to less than 40/1,000 live births (from 54) by 2011 (Brief of National Maternal, Neonatal and Child Health Programme, 2012). Government of Pakistan provides less than 1% for health care which is lower than Bangladesh and Sri Lanka (WPDS, 2006; UNDP, 2005).

In Pakistan data available on neonate death come mainly from hospital studies, which have a selective referral bias, or from communities in which the causes of death are hardly ever recorded. Information on pregnancy complications before delivery is limited.

Like other low income countries, little attention has been paid on MNCH in Pakistan. Studied conducted on maternal health are inadequate. Information related to MNCH is missing due to lack of awareness, low socio-economic status, lack of funding from government institutes. The available data on the estimate of MNCH and the risk factors associated with maternal, neonatal and child mortality is available for limited population. The present study was conducted to partly fill the information gap and to estimate the MNCH in Pakistan and the various risk factors associated with MNCH.

1.9 Aims and objectives

Current study focus maternal and child health in Pakistan among mothers belonging to different ethnic groups. Pakistan is an under developed country and not much work has been done for the improvement of maternal and neonate health, so the current study has following Aims and Objectives.

- Monitoring of the deliveries at Pakistan Institute of Medical Sciences (PIMS) and determining various anthropometric, physical and biological parameters of mother and child.

- To find the association of various maternal and neonatal parameters.

- Compare various anthropometric measurements of normal and anomalous neonates and their association with socio-biological status of mother.

- To identify the magnitude of prenatal and neonatal mortality and the risk factors associated with them

- To identify the various maternal risk factors and their association with adverse pregnancy outcome.

Subjects and Methods

2 Subjects and methods

2.1 Study area/sampling site

This current project was a descriptive, cross-sectional, genetic epidemiological study design. For the study of maternal and neonatal parameters and their association with pregnancy outcome and birth defects, Pakistan Institute of Medical Sciences (PIMS), Islamabad was selected. The study was conducted at Maternal and Child Health Care Center (MCH) located at PIMS. MCH center is closely connected with Project Type Technical Corporation (PTTC) of the Save Motherhood in Pakistan. MCH was established with the help of Japanese Government. It is equipped with highly advanced medical technology. It receives large number of patients from Rawalpindi, Islamabad and adjoining areas like Barakahu, Mal Pur, Kahota, Chakwal, Muree, Taxila, Wah Cantt, Azad Jammu and Kashmir, and various other suburban places.

The average daily workload of the visiting patient in Outpatient Department is 130. The daily average admissions in the In-patient Department are 25, emergency cases 20, and surgical cases are 6. MCH general ward including prenatal ward, postnatal ward, nursery and gynecology ward were visited for data collection in the current project. Private ward was not visited due to lack of co-operation from mothers and nurses.

2.2 Study subjects

Study subjects included all the neonates of general ward including normal, anomalous, stillbirth, and dead, including their mothers.

2.3 Ethical approval of project/ consent approval

Before starting the project, the research proposal was reviewed by the Review Committee of Department of Animal Sciences, Quaid-i-Azam University Islamabad. The research proposal was further evaluated by the Ethical Review Committee of PIMS. Then, project was approved by the relevant authorities of PIMS (Director and In charge of General Ward and Nursery), and permission was granted to me for data collection.

2.4 Preparative phase of the study

Before starting the project, Aims and Objectives of the study were clearly defined. For the purpose of training and practice, I visited MCH with senior research fellows of Human Genetics Lab so that I practically experienced the whole procedure of data collection, subject examination, questionnaire filling, file medical record checking, etc, before formal launching of my project.

2.5 Duration of data collection

Data were collected from September-2011 to December-2011. During this time 1,047 live births were monitored.

2.6 Questionnaire designing

Two questionnaires were designed on the basis of Aims and Objectives of this study. First questionnaire was related to neonate. It included gender, date and time of delivery, various anthropometric measurements (Length, OFC, weight, APGAR, respiration rate, heart rate, and blood group), parity, GA and diagnosis. It also includes maternal height, weight, RFTs and LFTs.

Information on demographic profile of mother, pregnancy record, marriage record and family history, were included in the second questionnaire.

2.7 Research team

Research team comprises two researchers from Human Genetics Lab QAU, Islamabad, including myself and on duty staff of PIMS (doctors and nurses).

2.8 Questionnaire filling

Questionnaires were filled by daily visits and by interviewing the mothers. Basic information like demography, marriage year, and family history was obtained by investigating the mothers. Other information like blood group, Hb, mode of delivery, reason for caesarian delivery, RFTs and LFTs were obtained from the medical record file.

Information regarding neonate like time of delivery and general health of neonate, were obtained. Anthropometric measurements like length, weight, OFC, APGAR score were also obtained from discharge slips. If both discharge slips and files were not available, then basic information like sex, weight, date and time of delivery, neonate's length and OFC

were taken on spot by me. Deliveries on holidays (weekends, Eids) were not included in the study.

2.9 Dysmorphologies record

In case of any anomaly, all the sign and symptoms were noted and marked. Clinical features were noted down and in case of doubt help was taken from the on duty medical officer.

2.10 Data entry, storage and statistical analysis

Data from questionnaire were entered and stored in MS Excel (ver. 7). Graph pad (prism 5) was used for statistical analysis. For statistical analysis only singleton, normal and alive births were considered. Twins, triplet, IUDs (Intra Uterine Deaths), dead, abortions and anomalies were excluded. Various maternal and neonatal parameters were compared and their association was calculated by applying statistical formulas like mean, standard deviation, χ^2 test, etc.

2.10.1 Statistical expressions used in analysis (Garstman, 2006)

$$\text{Percentage} = \frac{\text{No. of neonates with specific anomaly}}{\text{No. of total anomalies}} \times 100$$

$$\text{Proportion} = \frac{\text{No. of neonates with specific anomaly}}{\text{No. of total anomalies}}$$

$$\text{Prevalence} = \frac{\text{No. of neonates with specific anomaly}}{\text{No. of total subjects}} \times 1000$$

$$95\%\ CI = p \pm 1.96\sqrt{p(1-p)/N}$$

Where CI= confidence interval, p= probability, N= Total number of neonates

Results

3 Results

3.1 Demographic profile of neonates with respect to mother's parameters

3.1.1 Distribution of neonates with respect to pregnancy outcome

During the study, 1,047 deliveries were mentioned and 1,077 neonates were delivered at MCH, PIMS, and Islamabad. These were categorized as alive, IUDs, and dead. Of the 1,077 neonates delivered at PIMS, alive deliveries were 1,039 (96.47%), IUDs 24 (2.23%), postnatal deaths 13 (1.21%), and there was one abortion (0.09%). So, of the 1,077 neonates delivered, live born were maximum (Table 3.1.1; Fig. 3.1.1).

Table 3.1.1 Distribution of neonates with respect to pregnancy outcome

Outcome	No.	%age
Alive	1,039	96.47
IUD	24	2.23
Death	13	1.21
Abortion	1	0.09
Total	1,077	

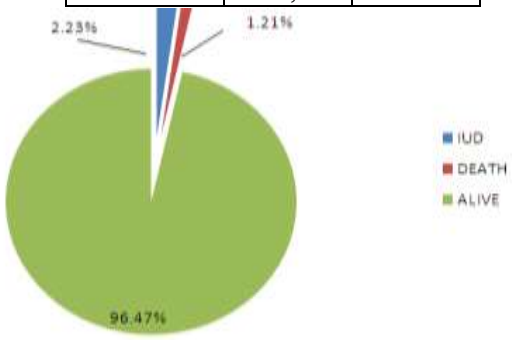

Fig. 3.1.1 Distribution of neonates with respect to pregnancy outcome .

3.1.2 Distribution of neonates with respect to singleton and multiple pregnancies

1,047 deliveries have been recorded at PIMS, Islamabad, which was categorized as singletons and multiples. Singletons included all single neonatal deliveries. More than one neonate in single pregnancy was categorized as multiple which included twins (two neonates in single pregnancy), and triplets (three neonates in a single pregnancy). Number of singleton pregnancies was 1,019 (97.32%). Number of multiple pregnancies was 28 (2.67%). Of the multiple pregnancies, 26 were twins (97.32%), while triplets were two (2.67%). So, majority of pregnancies were singleton (Table 3.1.2; Fig. 3.1.2).

Table 3.1.2 Distribution of neonates with respect to singleton and multiple pregnancies

Pregnancy outcome	No.	%age
Singleton	1,019	97.32
Multiple	28	2.67
Twins (in multiple births)	26	92.88
Triplets (in multiple births)	2	7.12

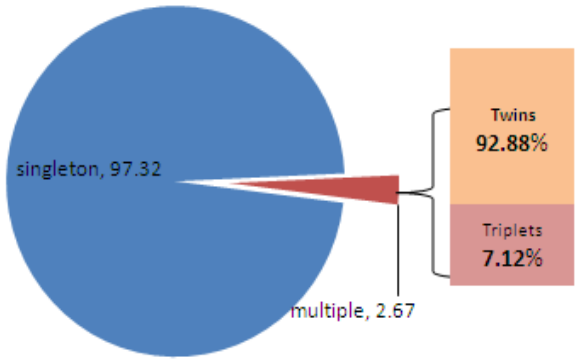

Fig. 3.1.2 Distribution of neonates with respect to singleton and multiple pregnancies.

3.1.3 Distribution of neonates according to their gender

Of the 1,077 neonates delivered at PIMS, majority were females, i.e., 50.32% (n=542) and there were 49.58% (n=534). One neonate was with ambiguous genitalia (Table 3.1.3; Fig. 3.1.3).

Table 3.1.3 Gender wise distribution of 1,077 neonates

Gender	No.	%age
Females	542	50.32
Male	534	49.58
Unknown	1	0.09
Total	1,077	

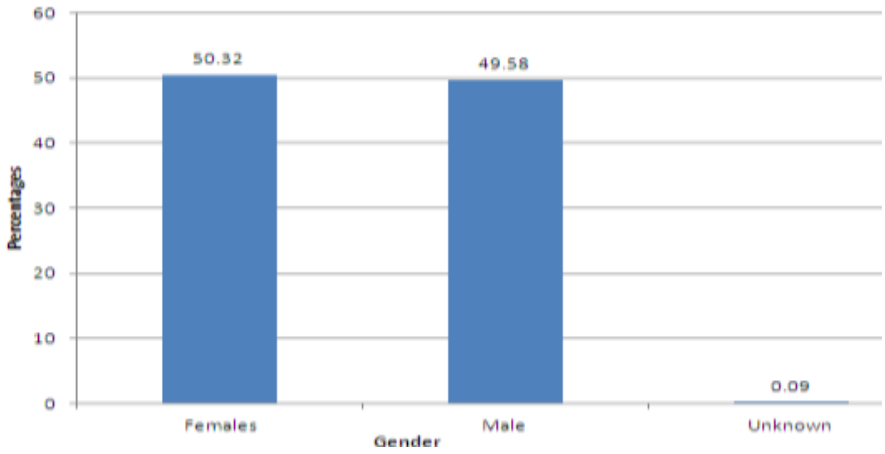

Fig.3.1.3 Distribution of neonates according to their gender.

3.1.4 Distribution of neonates according to parental province of residence

Distribution according to parental province of residence falls into following categories; Federal, Punjab, KPK, Sindh, and unknown. Majority of neonates were from Federal area (n=503) 48.04%, 475 from Punjab (45.37%), 32 from Azad Jammu and Kashmir (AJK) (3.06%), 32 from KPK (2.10%), 4 neonates from Sindh (0.38%), and 11 neonates from unknown origin (1.05%) (Table 3.1.4; Fig. 3.1.4).

Table 3.1.4 Distribution of 1,077 neonates according to parental province of residence

Province	No.	%age
Federal Area	503	48.04
Punjab	475	45.37
AJK	32	3.06
KPK	22	2.10
Sindh	4	0.38
Unknown	11	1.05
Total	1,047	

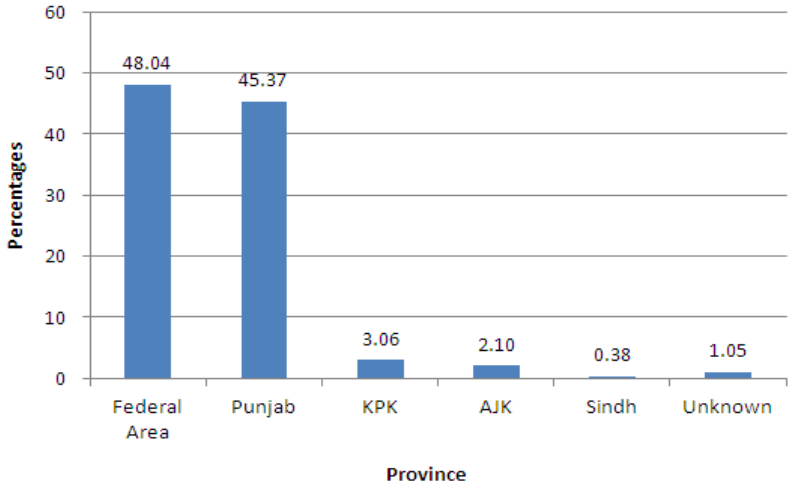

Fig. 3.1.4 Distribution of neonates according to parental province of residence

3.1.5 Gestational age (GA) of neonates

Majority of neonates had GA in the range of 36-40.99 week 87.62% (n=821). So, majority of neonates were born full term, 2.88% (n=27) were post-dated (GA 41-45.99 week), and 2.03% (n=19) were preterm (Table 3.1.5; Fig. 3.1.5).

TABLE 3.1.5 Gestational age of neonate

GA Rang (Week)	No.	%age
26-30.99	19	2.03
31-35.99	70	7.47
36-40.99	821	87.62
41-45.99	27	2.88
Total	937	

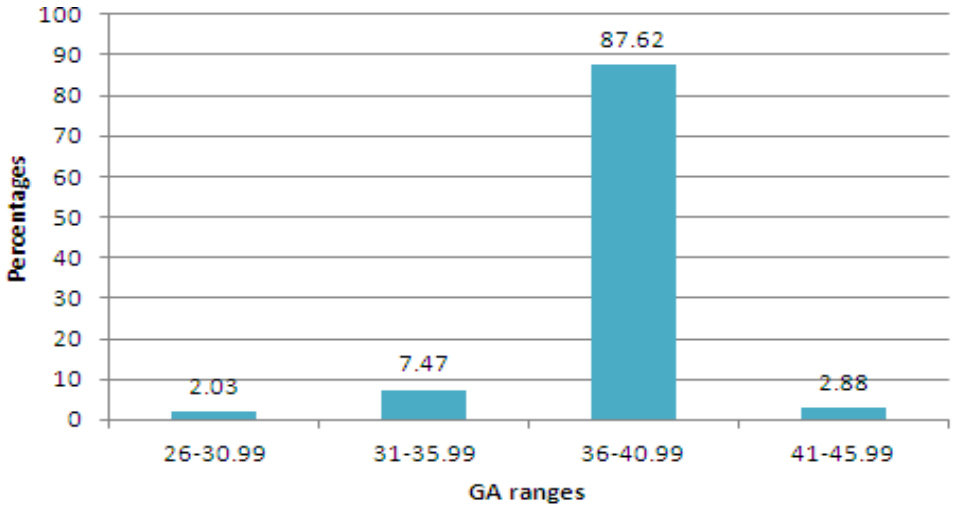

Fig. 3.1.5 gestational age of neonate

3.1.6 Mode of delivery of neonates

Majority of neonates were born through cesarean delivery 42.93% (n=404), 28.91% (n=272) were born through normal delivery, and 26.16% (n=265) were born through instrumental delivery (Table 3.1.6; Fig. 3.1.6).

Table 3.1.6 Mode of delivery of neonates

Mode of delivery	No.	%age
Cesarean delivery	404	42.93
Normal delivery	272	28.91
Instrumental delivery	265	28.16
Total	941	

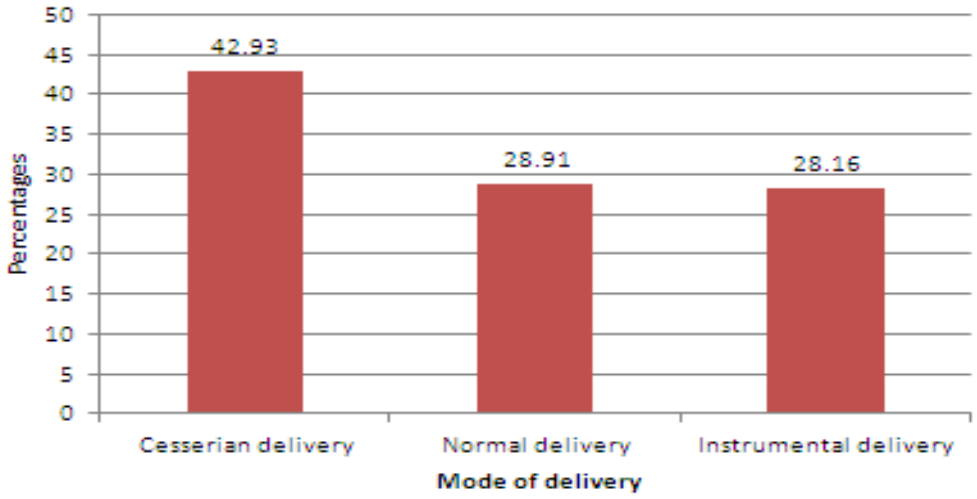

Fig. 3.4 Mode of delivery of neonates

3.1.7 Distribution of neonates according to maternal rural/ urban status

Majority of neonates were belonging to mothers from rural Punjab 48.46% (n=220) and 40.52% (n=186) to urban area, 44.71% (n=203) to rural Federal area and 56.43% (n=259) to urban Federal area. In the overall data, the majority of neonate's mothers were from rural area (Table 3.1.7; Fig. 3.1.7). Distribution according to maternal rural/ urban status was found to be significant.

Table 3.1.7 Distribution of neonates according to maternal rural urban status

Geographic distribution	Rural		Urban		Total	
	No.	%age	No.	%age	No.	%age
Punjab	220	48.46	186	40.52	406	44.47
Federal Area	203	44.71	259	56.43	462	50.60
AJK	19	4.19	4	0.87	23	2.52
KPK	12	2.64	6	1.31	18	1.97
Sindh	0	0.00	4	0.87	4	0.44
Total	454		459		913	

(χ^2 = 25.39; df.4; p<0.0001; significant)

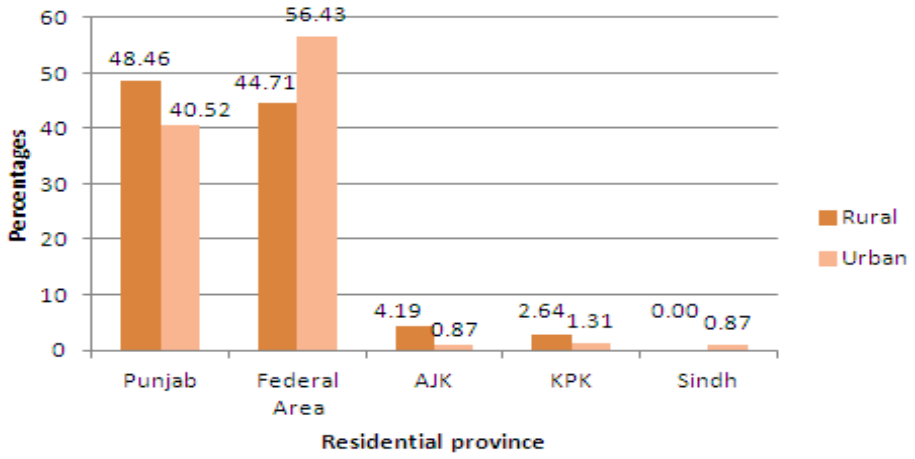

Fig. 3.1.7 Distribution of neonates according to maternal rural urban status

3.1.8 Distribution of neonates according to diagnosis

Of 1,018 neonates, maximum were diagnosed well; 83.40% (n=83.40%) were normal, 0.04% (n=92) had different morbidities. 4.32% (n=44) had different anomalies, and3.24% (n=33) had mortality (Table 3.1.8; Fig. 3.1.8).

Table 3.1.8 Distribution of neonates according to diagnosis

Diagnosis	No.	%age
Normal	849	83.40
Morbidities	92	9.04
Anomalies	44	4.32
Mortalities	33	3.24
Total	1018	

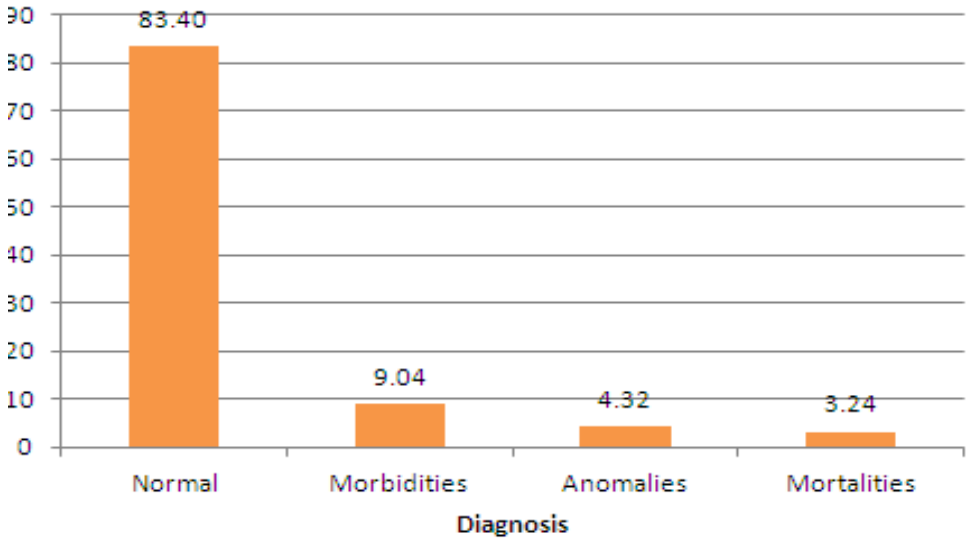

Fig. 3.1.8 Distribution of neonates according to diagnosis

3.2 Gender wise distribution of neonates and their association with maternal parameters

3.2.1 Distribution of normal male and female neonates with respect to parental province of residence

Of the 934 normal neonates, 479 were females and 455 males. Maximum number of them was belonging to Federal area and minimum from Sindh. The gender wise proportion of neonates was similar in all geographic area except Federal area where there were more female neonates compared with male (52.40% vs. 47.25%) (Table 3.2.1). Distribution of male and female neonates according to geographic area was significant.

Table 3.2.1 Distribution of normal male and female neonates with respect to parental province of residence

Geographic area	Female neonates		Male neonates		Total neonates	
	No.	%age	No.	%age	No.	%age
Fed.	251	52.40	215	47.25	466	49.89
Punjab	205	42.80	214	42.80	419	44.86
AJK	16	3.34	11	2.42	27	2.89
KPK	5	1.04	13	2.86	18	1.93
Sindh	2	0.42	2	0.44	4	0.43
Total	479		455		934	

(χ^2 = 195.0; df.9; p<0.0001; significant)

3.2.2 Distribution of male and female neonates according to maternal language

Maximum number of male and female neonates belonged to mother with Punjabi language and minimum were belonging to Potohari language,59.83% (n=283) and 56.79% (n=255) females and males respectively were belonging to Punjabi language, 10.57% (n=50) and 13.14% (n=59) females and males, respectively, were belonging to mother with Pushto language, 9.73% (n=46), and 8.24% (n=37) females and males, respectively, were belonging to mother with Pahari language, 8.25% (n=39) and 9.35% (n=42) females and males, respectively, were belonging to mother with Urdu language, 5.07% (n=24) and 6.01% (n=27) females and males, respectively, were belonging to mother with Hindko language, 2.96% (n=14) and 2.90% (n=13) females and males, respectively, were of Potohari language, and 3.59% (n=17) and 3.56% (n=16) females and males, respectively, were belonging to mother with other minor languages (Table 3.2.2).

Table 3.2.2 Distribution of males and female neonates according to maternal language

Maternal language	Female neonates		Male neonates		Total neonates	
	No.	%age	No.	%age	No.	%age
Punjabi	283	59.83	255	56.79	538	58.35
Pushto	50	10.57	59	13.14	109	11.82
Pahari	46	9.73	37	8.24	83	9.00
Urdu	39	8.25	42	9.35	81	8.79
Hindko	24	5.07	27	6.01	51	5.53
Potohari	14	2.96	13	2.90	27	2.93
Other	17	3.59	16	3.56	33	3.58
Total	473		449		922	

(χ^2 = 2.908; df.6; p=0.8202; not significant)

3.2.3 Distribution of male and female neonates according to maternal education

According to maternal education, normal and anomalous neonates were distributed into five major categories. Maximum number of neonates according to maternal education were fall into category 9-12, 35.43% (n=332) normal neonates and 40.91% (n=18) anomalous neonates (Table 3.2.3).

Table 3.2.3 Distribution of male and female neonates according to maternal education

Maternal education	Normal neonates		Anomalous neonates	
	No.	%age	No.	%age
Uneducated	152	16.22	9	20.45
1 to 8	246	26.25	7	15.91
9 to 12	332	35.43	18	40.91
13 & above	205	21.88	10	22.73
Others	2	0.21	0	0.00
Total	937		44	

(χ^2 = 2.664; df.4; p=0.6156; not significant)

3.2.4 Distribution of male and female neonates according to maternal occupation

Majority of normal and anomalous were belonged to mother who were housewife, 93.82% (n=880) and 95.45% (n=42) normal and anomalous neonates, respectively (Table 3.2.4).

Table 3.2.4 Distribution of male and female neonates according to maternal occupation

Maternal occupation	Normal neonates		Anomalous neonates	
	No.	%age	No.	%age
Housewife	880	93.82	42	95.45
Teaching	36	3.84	2	4.55
Govt. Job	13	1.39	0	0
Self Employed	4	0.43	0	0
Pvt.Job	3	0.32	0	0
Student	2	0.21	0	0
Total	938		44	

(χ^2 = 1.098; df.5; p=0.9542; not significant)

3.3 Anthropometric measurements of neonates

3.3.1 Body length of male and female neonates

There were 470 and 440 normal female and male neonates respectively. Five length ranges were identified (Table 3.2.1). Majority of neonates, both males and females, fall in body length range of 46-50.9cm, followed by the length in the range of 51-55cm (Table 3.3.1). Significant association was found between male and female neonates and body length ranges.

Table 3.3.1 Body length of male and female neonates

Body length(cm)	Female neonates		Male neonates		Total neonates	
	No.	%age	No.	%age	No.	%age
35-40.9	8	1.70	4	0.91	12	1.32
41-45.9	69	14.68	42	9.55	111	12.20
46-50.9	317	67.45	301	68.41	618	67.91
51-55.9	76	16.17	91	20.68	167	18.35
56-60.9	0	0.00	2	0.45	2	0.22
Total	470		440		910	

(χ^2 = 10.69; df.4; p=0.0303; significant)

3.3.2 Body weight ranges of male and female neonates

There were 477 and 454 normal female and male neonates, respectively. Five weight ranges were identified (Table 3.2.2). Most of the neonates, both males and females, fall in body weight range of 2.6-3.5kg, followed by weight range of 1.6-2.5kg (Table 3.3.2).

Table 3.3.2 Body weight ranges of male and female neonates

Body weight (kg)	Female neonates		Male neonates		Total	
	No.	%age	No.	%age	No.	%age
0.1-1.5	14	2.94	9	1.98	23	2.47
1.6-2.5	138	28.93	100	22.03	238	25.56
2.6-3.5	296	62.05	296	65.20	592	63.59
3.6-4.5	27	5.66	47	10.35	74	7.95
4.6-6.0	2	0.42	2	0.44	4	0.43
Total	477		454		931	

(χ^2 = 12.00; df.13; p=0.5278; not significant)

3.3.3 OFC ranges of males and females neonates

There were 470 and 440 normal female and male neonates, respectively. Three ranges of OFC were identified. Majority of the neonates, both males and females, fall in OFC range of 29.6-34.5cm, followed by OFC range of 34.6-45cm and then 24-29.5cm (Table 3.3.3). Significant association was found between male and female neonates and OFC ranges.

Table 3.3.3 OFC ranges of males and females neonates

OFC(cm)	Female neonates		Male neonates		Total neonates	
	No.	%age	No.	%age	No.	%age
24-29.5	13	2.77	9	2.05	22	2.42
29.6-34.5	374	79.57	285	64.77	659	72.42
34.6-45	83	17.66	146	33.18	229	25.16
Total	470		440		910	

(χ^2 = 29.12; df.2; p<0.0001; significant)

3.3.4 APGAR score of male and female neonates at 1min.

There were 332 and 312 normal female and male neonates, respectively. Table 3.2.6 shows six APGAR score ranges at 1min. Majority of the neonates, both males and females, fall in the APGAR score range of 6.0-7.0, followed by the APGAR score range 8.0-9.0. (Table 3.3.4).

Table 3.3.4 APGAR score of male and female neonates at 1min.

APGAR score	Females neonates		Male neonates		Total neonates	
	No.	%age	No.	%age	No.	%age
0.0-1.0	1	0.30	6	1.92	7	1.09
2.0-3.0	21	6.33	18	5.77	39	6.06
4.0-5.0	39	11.75	37	11.86	76	11.80
6.0-7.0	195	58.73	168	53.85	363	56.37
8.0-9.0	76	22.89	83	26.60	159	24.69
10.0-	0	0.00	0	0.00	0	0
Total	332		312		644	

(χ^2 = 5.556; df.5; p=0.3519; not significant)

3.3.5 APGAR score of male and female neonates at 5min.

There were 332 and 312 normal female and male neonates, respectively. Table 3.2.7 depicts six APGAR score ranges at 5min. Majority of the neonates, both males and females, fall in the APGAR score range of 8.0-9.0 followed by APGAR score range of 6.0-7.0 (Table 3.3.5)

Table 3.3.5 APGAR score of male and female neonates at 5min.

APGAR score	Female neonates		Male neonates		Total neonates	
	No.	%age	No.	%age	No.	%age
0.0-1.0	0	0.00	0	0.00	0	0
2.0-3.0	1	0.30	4	1.28	5	0.78
4.0-5.0	10	3.01	13	4.17	23	3.57
6.0-7.0	55	16.57	48	15.38	103	15.99
8.0-9.0	264	79.52	240	76.92	504	78.26
10.0-	2	0.60	7	2.24	9	1.40
Total	332		312		644	

(χ^2 = 5.972; df.4; p=0.2012; not significant)

3.4 Association of normal and anomalous neonates with various maternal parameters

3.4.1 Distribution of normal and anomalous neonate according to parental Consanguinity

The distribution of neonates was checked according to parental Anomalous neonates had more parental consanguinity 63.64% (n=28), compared to normal neonates 57.02% (n=536) (Table 3.4.1). Distribution of normal and anomalous neonates was significant.

Table 3.4.1 Distribution of normal and anomalous neonates according to marriage type

Marriage Type	Normal neonates		Anomalous neonates	
	No.	%age	No.	%age
Cousin marriages	536	57.02	28	63.64
Distantly related	119	12.66	5	11.36
Non-related	285	30.32	11	25.00
Total	940		44	

(χ^2 = 0.772; df.2; p=0.6797; significant)

3.4.2 Distribution of normal and anomalous neonates according to family type

Family types of parents were divided into five categories which were single, nuclear, grandparents and one couple, more than one couple, and extended family. Majority of normal neonates were belonging to extended family type with 59.11% (n=555), 26.94% to nuclear family type (n=253), 9.90% to grandparents and one couple (n=93), 3.51% to more than one couple family type (n=33), and 0.53% to single family type (n=5). In case of anomalous neonate majority were belonging to extended family type with 68.18% and (n=30), 18.18% to nuclear (n=8), 13.64% to grandparents and one couple (n=6). No anomalous neonates were from more than one couple and single family type (Table 3.4.2;). Distribution of male and female neonates according to family type was significant.

Table 3.4.2 Distribution of normal and anomalous neonate according to family type

Family Type	**Normal neonates**		**Anomalous neonates**	
	No.	**%age**	**No.**	**%age**
Extended family	555	59.11	30	68.18
Nuclear	253	26.94	8	18.18
Grandparents and one couple	93	9.90	6	13.64
More than one couple	33	3.51	0	0.00
Single	5	0.53	0	0.00
Total	939		44	

(χ^2 = 4.159; df.4; p=0.3849; significant)

3.4.3 Distribution of normal and anomalous neonates with respect to pregnancy outcome

Normal and anomalous neonates were distributed according to pregnancy outcome i.e., alive, IUDs, dead. Percentage and number of normal and anomalous neonates in these categories are given in Table 3.1.7 90.91% of anomalous neonates were live born compared with 96.51% of normal neonates in live births. Additionally, anomalous cases were represented by 4.55% each in IUDs and dead neonates compared with 2.6% and 1.13% IUDs and dead neonates among the normal deliveries (Table 3.4.3).

Table 3.4.3 Distribution of normal and anomalous neonates with respect to pregnancy outcome

Pregnancy outcome	Normal neonates		Anomalous neonates	
	No.	%age	No.	%age
Alive	941	96.51	40	90.91
IUD	22	2.26	2	4.55
Dead	11	1.13	2	4.55
Abortion	1	0.10	0	0.00
Total	975		44	

(χ^2 = 4.973; df.3; p=0.1738; not significant)

3.4.4 Distribution of normal and anomalous neonates with respect to maternal blood group

Majority of neonates were belonged to mother with blood group B^+, 32.05% (n=233) in case of normal neonates and 33.33% (n=8) in case of anomalous neonates, than O^+, 27.92% (n=203) in case of normal neonates and 33.33% (n=8) in case of anomalous neonates (Table 3.4.4).

Table 3.4.4 Distribution of normal and anomalous neonates with respect to maternal blood group

Blood group	Normal neonates		Anomalous neonates	
	No.	%age	No.	%age
B^+	233	32.05	8	33.33
O^+	203	27.92	8	33.33
A^+	160	22.01	6	25.00
AB^+	71	9.77	1	4.17
O^-	26	3.58	0	0.00
B^-	16	2.20	1	4.17
A^-	17	2.34	0	0.00
AB^-	1	0.14	0	0.00
Total	727		24	

($\chi^2 = 2.957$; df.7; p=0.8889; not significant)

3.5 Anomalous neonates

3.5.1 Distribution of anomalous neonates according to pregnancy outcome

Of the total anomalous neonates, 90.91% (n=40) were alive. Proportion of IUDs and dead was similar which was 4.55% (n=2) (Table 3.5.1).

Table 3.5.1 Distribution of anomalous neonates according to pregnancy outcome

Pregnancy outcome	No.	%age
Alive	40	90.91
IUDs	2	4.55
Dead	2	4.55
Total	44	

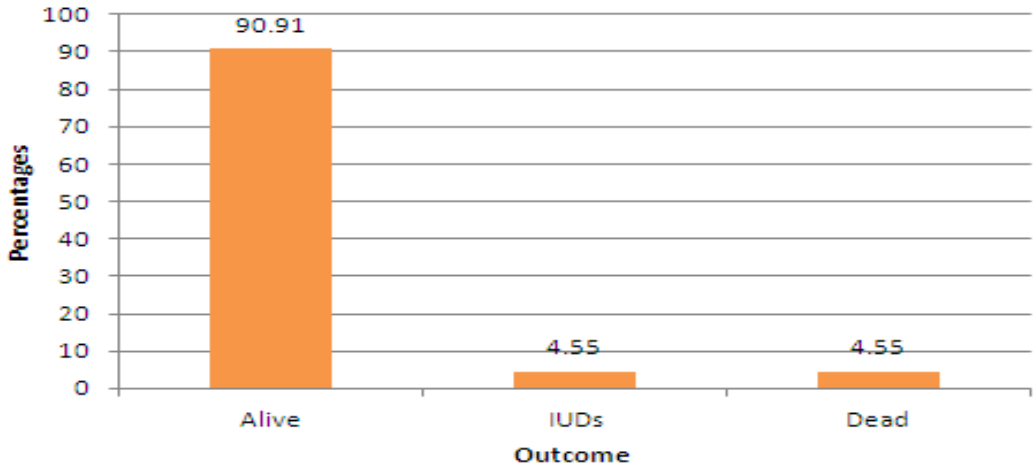

Fig. 3.5.1 Distribution of anomalous neonates according to pregnancy outcome

3.5.2 Distribution of anomalous neonates according to gender

Anomalous neonates were distributed according to gender. Majority of neonates were male 59.09% (n=26), 38.64% (n=17), and 2.27% had ambiguous genitalia (n=1) (Table 3.5.2; Fig 3.5.2).

Table 3.5.2 Distribution of anomalous neonates according to gender

Gender	No.	%age
Male	26	59.09
Female	17	38.64
Unknown	1	2.27
Total	44	

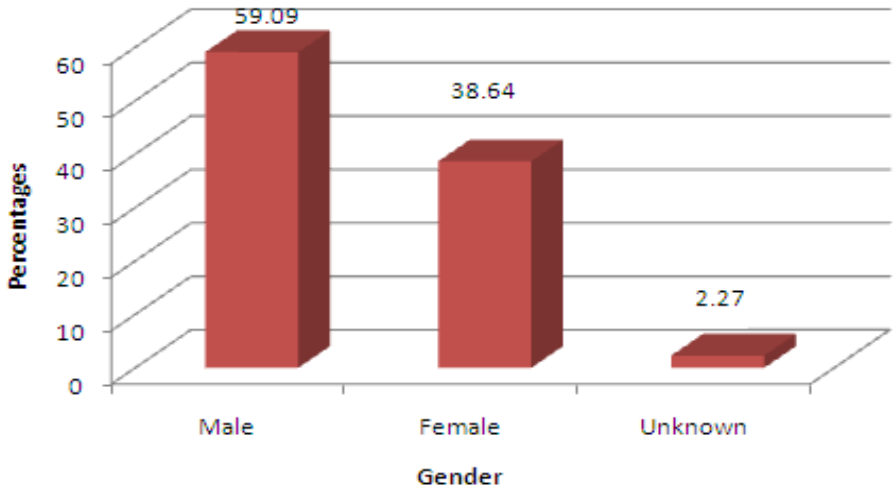

Figure 3.5.2 Distribution of anomalous neonates according to gender

3.5.3 Distribution of anomalous male and female neonates according to pregnancy outcome

Of the 44 anomalous neonates, majority were alive. Majority of anomalous neonates were male. Alive males were 54.55% (n=24), dead males were 4.55% (n=2), 36.36% (n=16) alive neonates were female and 2.77% were dead female (Table 3.5.3). Distribution of anomalous neonates (alive and dead), has significant association with gender.

Table 3.5.3 Distribution of anomalous male and female neonates according to pregnancy outcome

Gender	Alive neonates		Dead neonates		Total neonates	
	No.	%age	No.	%age	No.	%age
Male	24	54.55	2	4.55	26	59.10
Female	16	36.36	1	2.27	17	38.63
Unknown	0	0.00	1	2.27	1	2.27
Total	40		4			

(χ^2 = 10.27; df.2; p=0.0059; significant)

3.5.4 Classification and distribution of major anomalies

There were a total 44 anomalous neonates and were placed in to eight different categories. Musculoskeletal malformations were more prevalent among anomalous neonates, 29.55% (n=13), followed by CNS, 20.45% (n=9), and kidney problems, 15.91% (n=7) (Table 3.5.4).

Table 3.5.4 Classification and distribution of major anomalies

Anomaly type	**No.**	**%age**
Musculoskeletal malformations	13	29.55
Central Nervous system (CNS) defects	9	20.45
Kidney problems	7	15.91
Syndromic cases	5	11.36
Orofacial	3	6.82
Digestive system problem (GIT)	1	2.27
Other	6	13.64
Total	44	

3.5.5 Prevalence of CM in 1,047 births

Prevalence rate per 1,000 and proportion of each anomaly type was calculated. Musculoskeletal malformations were found to be more prevalent, i.e., 29.55% with the prevalence rate of 12.07/1,000, 20.45% were CNS defects with prevalence rate of 8.36/1,000. Kidney diseases were 15.91%, (prevalence rate 6.30/1,000). Then syndromic cases which were 11.36%, prevalence were 4.64/1,000. Next were the orofacial defects, 6.82%, and prevalence was 2.79/1,000; GIT defects were 2.27% and prevalence was 0.93/1,000; Remaining 13.64% were belonging to other groups, prevalence was 5.57% (Table 3.5.5).

Table 3.5.5 Prevalence of CM in 1,047 births

Musculoskeletal malformations	**No.**	**%age**	**Prevalence**	**Proportion**	**95% CI±1.96**
Skeletal dysplasia + other	1	2.27	0.93	0.02	0.01163-0.02836
Talipes + Cleft palate	1	2.27	0.93	0.02	0.01163-0.02836
Tlipes + Meningomyocoel	1	2.27	0.93	0.02	0.01163-0.02836
Talipes	1	2.27	0.93	0.02	0.01163-0.02836
First toe duplicated	1	2.27	0.93	0.02	0.01163-0.02836
Polycactyly	2	4.55	1.86	0.05	0.01163-0.02836
Peduncus post minimus	1	2.27	0.93	0.02	0.01163-0.02836
Syndactyly	1	2.27	0.93	0.02	0.01163-0.02836
Syndactyly + other	1	2.27	0.93	0.02	0.01163-0.02836
Dislocated knee	1	2.27	0.93	0.02	0.01163-0.02836
External rotation of right foot	1	2.27	0.93	0.02	0.01163-0.02836
Dysmorphic fingers of hand and feet	1	2.27	0.93	0.02	0.01163-0.02836
Total	**13**	**29.55**	**12.07**	**0.30**	**0.13956-0.34032**
Central nervous system defects					
Meningocoel	1	2.27	0.93	0.02	0.01163-0.02836
Menigocoel + Hydroceph	2	4.55	1.86	0.05	0.03698-0.06301
Meningomyocoel + other	1	2.27	0.93	0.02	0.01163-0.02836
Hydroceph	2	4.55	1.86	0.05	0.03698-0.06301
Microcephaly	1	2.27	0.93	0.02	0.01163-0.02836
Microcephaly + other	1	2.27	0.93	0.02	0.01163-0.02836
Spina bifida + abdominal distention	1	2.27	0.93	0.02	0.01163-0.02836
Total	**9**	**20.45**	**8.36**	**0.20**	**0.13211-0.26782**
Kidney diseases					
Hydronephrosis + other	2	4.55	1.86	0.05	0.03698-0.06301
Bilateral hydronephrosis	1	2.27	0.93	0.02	0.01163-0.02836
Unilateral mild hydronephrosis	1	2.27	0.93	0.02	0.01163-0.02836
Multicystic dysplastic kidney + others	3	6.82	2.79	0.07	0.05476-0.08523
Total	**7**	**15.91**	**6.30**	**0.16**	**0.11500-0.20496**
Syndromic cases					
Down syndrome	2	4.55	1.86	0.05	0.03698-0.06301
Sydromic	2	4.55	1.86	0.05	0.03698-0.06301
Sydromic + multiple anomalies	1	2.27	0.93	0.02	0.01163-0.02836

Total	**5**	**11.36**	**4.64**	**0.11**	**0.07396-0.15438**
Orofacial anomalies					
Cleft palate	1	2.27	0.93	0.02	0.01163-0.02836
Malformed ears	1	2.27	0.93	0.02	0.01163-0.02836
Yellowish discolortion of skin	1	2.27	0.93	0.02	0.01163-0.02836
Total	**3**	**6.82**	**2.79**	**0.07**	**0.03489-0.08508**
Gastrointestinal tract (GIT) defects					
Imperforated anus	1	2.27	0.93	0.02	0.01163-0.02836
Others					
Hydrops fetalis, Rh incompatibility	1	2.27	0.93	0.02	0.01163-0.02836
Bruice on buttock	1	2.27	0.93	0.02	0.01163-0.02836
Swelling over back, right eye smaller than left	1	2.27	0.93	0.02	0.01163-0.02836
Hernia	1	2.27	0.93	0.02	0.01163-0.02836
Sinus at lumbo saccral region	1	2.27	0.93	0.02	0.01163-0.02836
Swollen left foot, fetal bradycardia	1	2.27	0.93	0.02	0.01163-0.02836
Total	**6**	**13.64**	**5.57**	**0.14**	**0.06978-0.17016**

3.5.6 Classification and distribution of morbidities

Different categories pertaining to morbidities were identified. Majority of neonates were preterm or low birth weight 17.02% (n=16), followed by meconium 15.96% (n=15), 12.77% (n=12) had respiratory distress, and almost same proportion of neonates had tachypenia 11.70% (n=11). (Table 3.5.6).

Table 3.5.6 Classification and distribution of morbidities

Morbidity type	**No.**	**%age**
Preterm/ Low birth weight	16	17.02
Meconium	15	15.96
Respiratory distress	12	12.77
Tachypenia	11	11.70
Shifted to NICU	10	10.64
Lethargy/Poor activity	6	6.38
Intra uterine growth resistance (IUGR)	4	4.26
Birth asphyxia	3	3.19
Sepsis	3	3.19
Caput succedaneum	2	2.13
Cyanosis	2	2.13
Hepatitis	2	2.13
Fever	1	1.06
Pneumonia	1	1.06
Other	6	6.38
Total	94	

3.5.7 Parity/ birth order of anomalous neonates

Greater number of neonates had first order parity 38.64% (n=17), followed by para2 22.73% (n=10). With increasing parity the ratio of anomalous babies decreases. So, the rate of anomalous babies was higher in primiparous women (Table 3.5.7; Fig 3.5.7).

Table 3.5.7 Parity/ Birth order of anomalous neonates

Parity	No.	%age
Para1	17	38.64
Para2	10	22.73
Para3	5	11.36
Para4	7	15.91
Para5	2	4.55
Para6 & above	3	6.82
Total	44	

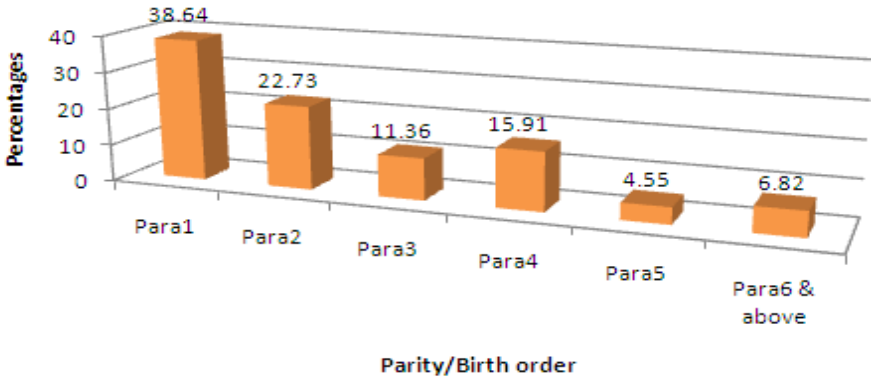

Fig.3.5.7 Parity/ birth order of anomalous neonates

3.5.8 Distribution of anomalous male and female neonates with respect to parity

The association of parity with anomalous male and female neonates was observed. Greater number of neonates showed first order parity 42.41% male (n=11), and 35.29% (n=6) females. (Table 3.5.8).

Table 3.5.8 Distribution of anomalous male and female neonates with respect to parity

Parity	Male neonates		Female neonates		Total neonates	
	No.	%age	No.	%age	No.	%age
Para1	11	42.31	6	35.29	17	38.64
Para2	5	19.23	5	29.41	10	22.73
Para3	4	15.38	1	5.88	5	11.36
Para4	4	15.38	3	17.65	7	15.91
Para5	1	3.85	1	5.88	2	4.55
Para6 & above	1	3.85	1	5.88	3	6.82
Total	26		17		44	

(χ^2 = 1.78; df.10; p=0.9977; non-significant)

3.5.9 Association of parity/ birth order of neonates with maternal age

Association of parity with maternal age was explored. Greater number of neonates were belonging to first parity order and maternal age range was <25 that was 72.22% (n=13), and then high anomalous neonates were observed in second order parity and fourth order parity 28.57% in both cases and maternal age range was >30 and then high percentage of anomalous neonates were observed in the range 25-30 that was 26.32% in third and fourth order parity (Table 3.5.9). Significant association was observed between parity and maternal age.

Table 3.5.9 Association of parity/ birth order of neonates with maternal age

Parity	**Maternal age**					
	<25		**25-30**		**>30**	
	No.	**%age**	**No.**	**%age**	**No.**	**%age**
Para1	13	72.22	3	15.79	1	14.29
Para2	4	22.22	4	21.05	2	28.57
Para3	0	0.00	5	26.32	0	0.00
Para4	0	0.00	5	26.32	2	28.57
Para5	1	5.56	1	5.26	0	0.00
Para6 & above	0	0.00	1	5.26	2	28.57
Total	18		19		7	

(χ^2 = 27.00; df.10; p=0.0026;significant)

3.5.10 Prevalence of morbidities

Preterm deliveries were more prevalent, 17.02% and prevalence rate of 14.86/1,000. Meconic cases were 15.96%, prevalence was 13.93/1,000. Next were respiratory distress, 12.77% and prevalence was 11.14/1,000 and so on (Table 3.5.10).

Table 3.5.10 Prevalence of morbidities

Morbidity type	No.	%age	Prevalence	Proportion
Preterm/ Low birth weight	16	17.02	14.86	0.17
Meconium	15	15.96	13.93	0.16
Respiratory distress	12	12.77	11.14	0.13
Tachypenia	11	11.70	10.21	0.12
Shifted to NICU	10	10.64	9.29	0.11
Lethargy/Poor activity	6	6.38	5.57	0.06
Intra uterine growth resistance (IUGR)	4	4.26	3.71	0.04
Birth asphyxia	3	3.19	2.79	0.03
Sepsis	3	3.19	2.79	0.03
Caput succedaneum	2	2.13	1.86	0.02
Cyanosis	2	2.13	1.86	0.02
Hepatitis	2	2.13	1.86	0.02
Fever	1	1.06	0.93	0.01
Pneumonia	1	1.06	0.93	0.01
Other	6	6.38	5.57	0.06
Total	94		87.28	1

3.6 Association of neonates weight ranges and maternal parameters

3.6.1 Distribution of neonate's weight with respect to maternal parameters

Chi-square test is statistical test use to find out random distribution of sample or data. It is used to find out whether the distribution is significant or not. Chi-square test was applied to test the association between neonate weight ranges and various maternal parameters. Statistically significant distribution of neonate weight ranges and parental residence was found, and non-significant association exists between neonate weight ranges and other parameters. (Table 3.6.1).

Table 3.6.1 Distribution of neonates weight range with respect to maternal parameters

	Neonates weight (kg) ranges			
Family type	<2.0	2.0-3.0	>3.0	**Total**
Extended family	35	335	179	549
Nuclear	21	139	90	250
Grandparents and one couple	6	57	29	92
More than one couple	2	20	11	33
Single	0	4	1	5
Total	64	555	310	929
				χ^2 = 3.702; df.8; p=0.883; non-significant
Parental consanguinity				
Close marriages	33	316	118	467
Distantly related	10	72	35	117
non-related	21	169	94	284
Total	64	557	247	868
				χ^2 = 6.163; df.4; p=0.1873; non-significant
Parental residence				
Federal	17	277	169	463
Punjab	39	252	119	410
AJK	5	15	6	26
KPK	2	5	11	18
Sindh	0	1	3	4
Total	63	550	308	921
				χ^2 = 32.48; df.8; p<0.0001; significant
Maternal age interval				
15-19	3	29	10	42
20-24	18	192	93	303
25-29	24	203	119	346
30-34	10	91	64	165
35-45	8	33	23	64
Total	63	548	309	920
				χ^2 = 9.604; df.8; p=0.2939; non-significant

3.6.2 Association of anthropometric measurements neonates with maternal parameters

Association of anthropometric measurements of neonates with maternal parameter was calculated. Mean length of neonates according to geographic region was (48.75±2.76), and according to maternal language was (48.49±2.57). Mean weight according to geographic region was (2.91±0.62), and according to maternal language, was (2.86±0.55). Mean OFC according to geographic region was (34.06±1.60), and according to maternal language was, (33.71±1.61). (Table 3.6.2)

Table 3.6.2 Association of anthropometric measurements neonates with maternal parameters

Geographic region	**Gender**		**Length**		**Weight**		**OFC**	
	Male	**Female**	**n**	**Mean±SD**	**N**	**Mean±SD**	**n**	**Mean±SD**
Punjab	214	205	405	48.05±2.90	415	2.78±0.58	405	33.56±1.97
Fed	215	251	454	48.54±2.62	463	2.88±0.52	454	33.67±1.47
AJK	11	16	26	48.83±3.11	26	2.63±0.76	26	33.31±2.15
KPK	13	5	16	49.59±3.70	18	3.09±0.91	16	34.77±2.43
Sind	2	2	4	48.75±1.50	4	3.18±0.34	4	35.00±0.00
Total	455	479	905	48.75±2.76	926	2.91±0.62	905	34.06±1.60
								χ^2 = 0.1182; df.8; p=1.0000; non-significant
Maternal language								
Punjabi	255	283	517	48.13±2.88	533	2.81±0.57	517	33.56±1.84
Pushto	59	50	105	48.84±2.56	107	2.93±0.53	105	33.94±1.61
Pahari	37	46	80	48.28±2.91	82	2.68±0.61	80	33.47±1.76
Urdu	42	39	80	49.24±2.13	80	2.95±0.48	80	33.83±1.21
Hindko	27	24	51	48.56±1.50	51	2.93±0.72	51	33.83±1.88
Potohari	13	14	27	47.69±2.37	27	2.80±0.38	27	33.54±1.42
Other	16	17	32	48.73±2.42	33	2.94±0.59	32	33.84±1.53
Total	449	473	892	48.49±2.57	913	2.86±0.55	892	33.71±1.61
								χ^2 = 0.07802; df.12; p=1.0000; non-significant

3.7 Pregnancy Induced Hypertension (PIH)

3.7.1 Parental residence and its association with normal neonates and neonates born to mother having PIH

Greater percentages of neonates born to mothers with PIH were from Federal area 54.65% (n=47), compared to normal 49.64% (n=419), followed by Punjab 37.21% in case of neonates born to mothers having PIH compared to normal 45.38% (Table 3.7.1)

Table 3.7.1 Parental residence and its association with normal neonates and neonates born to mother with PIH

Parental Residence	Normal		PIH	
	No.	%age	No.	%age
Federal area	419	49.64	47	54.65
Punjab	383	45.38	32	37.21
AJK	23	2.73	4	4.65
KPK	15	1.78	3	3.49
Sindh	4	0.47	0	0.00
Total	844		86	

(χ^2 = 4.143; df.4; p=0.387; non-significant)

3.7.2 Association of marriage type with normal neonates and neonates born to mother with PIH

Greater number of neonates born to mother with PIH had parental consanguinity 64.77% (n=57)**,** 56.22% (n=479) in the case of neonates born to normal mothers (Table 3.7.2; Fig.3.7.2).

Table 3.7.2 Association of marriage type with normal neonates and neonates born to mother with PIH

	Normal		PIH	
Marriage type	**No.**	**%age**	**No.**	**%age**
Cousin marriages	479	56.22	57	64.77
Distantly related	113	13.26	6	6.82
Non-related	260	30.52	25	28.41
Total	852		88	

(χ^2 = 3.757; df.2; p=0.1528; non-significant)

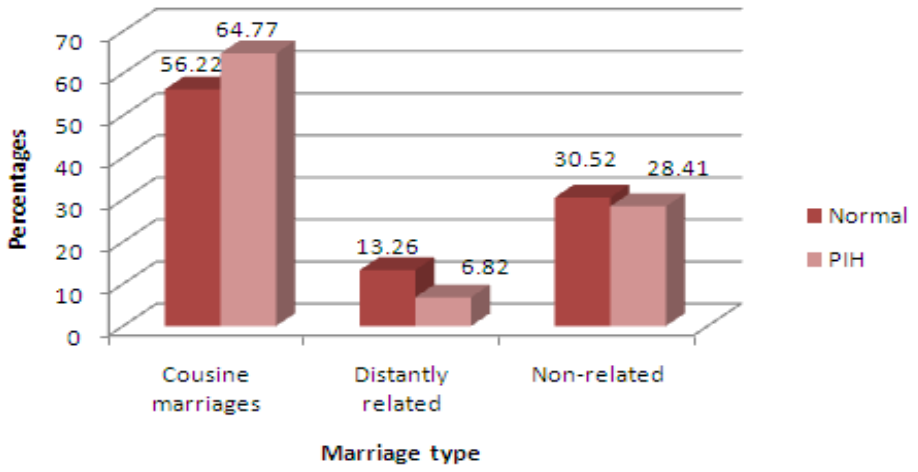

Fig. 3.7.2 Association of marriage type with normal neonates and neonates born to mother with PIH

3.7.3 Association of mode of delivery with normal neonates and neonates born to mothers with PIH

Greater number of neonates born to mother with PIH were born through cesarean delivery 77.01% (n=67), compared to normal in which 39.39% were born through cesarean delivery. (Table 3.7.3). Statistically significant association was found between mode of delivery and normal neonates, and neonates born to mother with PIH.

Table 3.7.2 Association of mode of delivery with normal neonates and neonates born to mothers with PIH

Mode of delivery	Normal		PIH	
	No.	%age	No.	%age
Cesarean	336	39.39	67	77.01
Normal	264	30.95	8	9.2
Instrumental	253	29.66	12	13.79
Total	853		87	

(χ^2 = 46.03; df.2; p<0.0001;significant)

3.7.4 Association of pregnancy outcome with normal neonates and neonates born to mothers with PIH

Majority of neonates born to mother with PIH were alive, 88.89% compared to normal 97.49% , 7.07% were IUD,S in case of mothers with preeclampsia, compared to normal in which 1.75% were IUDs, postnatal deaths were 4.04% in case of neonates born to mother with PIH, compared to 0.82% in case of normal neonates (Table 3.7.4). Statistically significant association exists between pregnancy outcome and normal neonates, and neonates born to mothers with PIH.

Table 3.7.4 Association of pregnancy outcome with normal neonates and neonates born to mothers with PIH

Pregnancy outcome	Normal		PIH	
	No.	%age	No.	%age
Alive	853	97.49	88	88.89
Intrauterine death	15	1.75	7	7.07
Postnatal death	7	0.82	4	4.04
Total	875		99	

(χ^2 = 20.25; df.2; p<0.0001;significant)

3.7.5 Association of maternal age with normal neonates and neonates born to mother with PIH

Mean age in the case of PIH was 27.04±1.42 and in the case of normal neonates was 26.84±1.35. Maximum number of neonates born to mother with PIH were in the range 25-29 and were 37.50% (n=33), and maximum number of neonates born to normal mothers were also in the same range and were 33.77% (Table 3.7.5).

Table 3.7.5 Association of maternal age with normal neonates and neonates born to mother with PIH

Maternal age	Normal			PIH		
	No.	%age	Mean±SD	No.	%age	Mean±SD
15-19	39	4.63	18.36±0.78	3	3.41	18.00±1.00
20-24	286	33.97	22.24±1.35	20	22.73	22.35±1.35
25-29	318	37.77	26.46±1.32	33	37.50	26.73±1.40
30-34	144	17.10	30.83±1.21	22	25.00	30.95±1.21
35-45	55	6.53	36.35±2.12	10	11.36	37.20±2.20
	842		26.84±1.35	88		27.04±1.42

(χ^2 = 8.769; df.4; p=0.0671;non-significant**)**

3.7.6 OFC range of normal neonates and neonates born to mother with PIH

OFC range of the normal male and female and neonates born to mothers with PIH were compared. Mean OFC was 32.04±1.21 and 32.19±1.29 in case of normal male and female respectively, and 32.11±0.89 and 34.22±1.89 in case of female sand males respectively born to mother with PIH. Maximum number of neonates, both normal and born to mothers with PIH has OFC in the range 29.6-34.5 and were 79.24% and 63.30% normal female and male respectively and 82.35% in case of PIH females and males, respectively (Table 3.7.6). Statistically significant association exists between OFC range and normal female and males, and females and males neonates belonging to mothers with PIH.

Table 3.7.6 OFC range of normal neonates and neonates born to mother with PIH

Neonates weight (kg)	Normal females			Normal males			PIH					
							Female neonates			Male neonates		
	No.	%age	Mean±SD	No.	%age	Mean±SD	No.	%age	Mean±SD	No.	%age	Mean±SD
0.1-1.5	13	3.06	1.27±0.30	7	1.67	1.27±0.25	1	1.92	1.2	2	5.56	1.20±0.42
1.6-2.5	114	26.82	2.29±0.22	85	15.55	2.25±0.28	24	46.15	2.10±0.31	15	41.67	1.99±0.27
2.6-3.5	274	64.47	2.98±0.27	280	66.99	3.00±0.26	22	42.31	3.00±0.25	16	44.44	2.97±0.20
3.6-4.5	22	5.18	3.75±0.18	44	10.53	3.79±0.20	5	9.62	3.88±0.30	3	8.33	4.03±0.42
4.6-6.0	2	0.47	4.65±0.07	2	0.48	5.20±0.85	0	0.00	0	0	0.00	0
	425			418			52			36		

(χ^2 = 38.01;df.6; p<0.0001;significant)

3.7.7 Length range of normal neonates and neonates born to mother with PIH

Majority of neonates both normal male and female and male and female neonates born to mother with PIH had length in the range of 46-50.9 (Table 3.7.7). Significant association exists between neonates body length range and neonates born to normal mothers and that born to mothers with PIH.

Table 3.7.7 Length range of normal neonates and neonates born to mother with PIH

Length range (cm)	Normal females			Normal males			PIH females			PIH males		
	No.	%age	Mean±SD	No.	%age	Mean±SD	No.	%age	Mean±SD	No.	%age	Mean±SD
35-40.9	7	1.67	40.59±1.31	4	0.99	38.00±2.16	1	1.96	40	0	0.00	0
41-45.9	53	12.65	43.91±1.57	35	8.62	44.01±1.27	16	31.37	43.44±1.57	7	20.59	43.64±1.18
46-50.9	290	69.21	48.23±1.22	279	68.72	48.46±1.23	27	52.94	48.41±1.29	22	64.71	47.86±1.43
51-55.9	69	16.47	51.81±0.92	86	21.18	52.05±1.11	7	13.73	52.14±1.07	5	14.71	52.40±0.55
56-60.9	0	0.00	0	2	0.49	56.50±0.71	0	0.00	0	0	0.00	0
Total	419			406			51			34		

(χ^2 = 30.79;df.12; p=0.0021;significant)

3.7.8 Weight ranges of normal neonates and neonates born to mothers with PIH

Majority of normal neonates show weight in the range 2.6-3.5, 69.21% and 68.72% female and male neonates respectively, and female neonates born to mother with PIH had weight in the range 1.6-2.5, which showed that they were small for GA, and male neonates showed weight in the range 2.6-3.5. (Table 3.7.8). Significant association exists between neonates weight range and normal male and female neonates and neonates born to mother with PIH.

Table 3.7.8 Weight ranges of normal neonates and neonates born to mothers with PIH

OFC ranges (cm)	Normal females			Normal males			PIH females			PIH males		
	No.	%age	Mean±SD	No.	%age	Mean±SD	No.	%age	Mean±SD	No.	%age	Mean±SD
24-29.5	10	2.39	27.75±1.93	9	2.22	27.61±2.13	3	5.88	28.33±1.04	0	0.00	0
29.6-34.5	332	79.24	33.06±1.11	257	63.30	33.41±0.94	42	82.35	32.65±1.22	28	82.35	32.99±1.25
34.6-45	77	18.38	35.29±0.57	140	34.48	35.54±0.80	6	11.76	35.33±0.41	6	17.65	35.45±0.64
Total	419		32.04±1.21	406		32.19±1.29	51		32.11±0.89	34		34.22±1.89

(χ^2 = 34.93;df.12; p=0.0005;significant)

3.7.9 Relationship of normal neonates and neonates born to mother with PIH with gestational age

Majority of normal neonates had mean gestational age 37.93±0.38 and neonates born to mother with PIH had mean gestational age 37.88±0.39, so association of gestational age with neonates born to normal mothers and neonates born to mother with PIH. (Table 3.7.9).

Table 3.7.9 Relationship of normal neonates and neonates born to mother with PIH with gestational age

Gestational age	Normal			PIH		
	No.	%age	Mean±SD	No.	%age	Mean±SD
27-29.99	4	0.47	28.36±1.08	0	0.00	0
30-32.99	18	2.12	30.56±0.88	1	1.15	32
33-35.99	54	6.35	34.66±0.57	12	13.79	34.65±0.58
36-38.99	593	69.76	37.93±0.38	51	58.62	37.88±0.39
39-41.99	173	20.35	39.75±0.71	21	24.14	39.72±0.73
42-44.99	8	0.94	42.46±0.26	2	2.30	42.01±0.01
Total	850			87		

(χ^2 = 10.31;df.5; p=0.0669;non-significant**)**

Discussion

4. Discussion

Epidemiology is the study of the distribution and determinants of health-related states or events in specified populations, and the application of this study to the control of health problems (Last, 1988). Epidemiology refers to the basic science of public health. Epidemiology deals with the frequency and pattern of health events in a population. Clinicians are concerned with the health of individual whereas, epidemiologist is concerned with overall health of people in a community or any other area. Epidemiology is helpful to us in many ways, e.g. population or community health assessment, individual decisions, completing the clinical picture, search for causes, disease investigation, analytical studies, evaluation, and so on.

Genetic epidemiology deals with the role of genetic factors in determining health and diseases in families and populations and association of genetic factors with environmental factors. It deals with the etiology, distribution and inherited cause of disease in a population (Morton, 1982).

Among children of low-income and under developed countries, health care has been considered as an issue of great concern. Malformations, neurological problems, mental retardation has become a great problem in developing countries such as Pakistan. Very little attention has been paid on research in developing countries, so the aim of this study was to investigate the child health in Pakistan (WHO). Only few epidemiological studies have been conducted in Pakistan about maternal and child health and there is need for such studies in order to know maternal and child health and various risk factors associated with them. India, Bangladesh and Pakistan are the south central Asian regions, had the second largest population of children throughout the world. Of these three countries, only Bangladesh has reduced under-

five deaths to almost half of its 1990 level by 2002, at an average annual reduction rate of 5.2%. On the other hand, India and Pakistan still have high child mortality rate below the 1990 level (Tanzi and Gabay, 2002). It has been proposed that better post-partum health care practices reduced neonatal mortality and morbidity, and safe delivery practices like clean cord care (umbilical cord should be cut with sterilized instrument and tying it with a thread), thermal care (drying and wrapping the newborn immediately after delivery and newborn bath should be delayed for at least 6 hours or for several days to reduce the hypothermia risk) (Darmstadt et al., 2005; Awasthi et al., 2008)

Due to general lack of awareness and lack of cooperation from people such studies are very difficult to conduct in field, so hospital was chosen for this study as due to cooperation of medical staff descriptive epidemiological study was relatively easy.

Pregnancy outcome was explored, majority of neonates were alive, 96.47%, IUDs were 2.23% and postnatal deaths were 1.21% and abortions were 0.09%. In this study, singleton pregnancies were 97.32% and multiple pregnancies were 2.67%. Of multiple pregnancies 92.88% were twin pregnancies and 7.12% were triplets. Majority of neonates were females 50.32% and male neonates were 49.58% and unknown were 0.09% which is different from the observation of Chaudhry (2011), majority of neonates were male.

In the present study, neonates belonging to mothers from Federal area and Punjab were 48.04% and 45.37% respectively, which is higher than studied by Anjum, (2012), 43.42% and 37.96% respectively, lower than studied by Chaudhry, (2011) from Federal, 53% and higher than proposed by Chaudhry (2011), from Punjab that was 41.

Majority of neonates show GA in the range ≥ 9 months that was 87.62% and 2.88% were ≥10 months. Remaining 9.50% were delivered preterm (<9 months), which were much lower than proposed by Jehan et al. (2007) that was 33.6/1,000.

Caesarean deliveries were 42.93%, which was consistent with Olusanya and Solanke. (2009) and was 56%, normal deliveries were 28.91% and instrumental delivery was 28.16%.

Distribution of neonates according to parental geographic region and rural urban status was found to be statistically significant ($p < 0.0001$).

Majority of neonates were alive and normal 83.40%, 9.04% had different morbidities, and 4.32% had different anomalies which is higher than observed by Karbasi et al. (2009) and Movafagh et al. (2008) 2.83% and 2.9% respectively and consistent with observed by Gustavson (2005), and Jehan et al. (2007) that was 5% and 4% respectively. In this study, mortality rate was 3.24%, and stillbirths were 2.23%, (lower than Gustavson (2005), 5.4%. Postnatal deaths were 1.21% which is much less than Gustavson (2005), 10%.

Distribution of normal male and female neonates with respect to maternal parameters were also explored which included geographic area, maternal language, maternal education and maternal occupation. Distribution was found to be statistically significant according to geographic area ($p<0.0001$). Non-significant distribution was observed in other parameters.

Anthropometric measurements of male and female neonates were also calculated for male and female neonates in different ranges, these included length, weight, OFC, APGAR score

at 1min. and 5min, respectively. Only significant association was found between length ranges and male and female neonates, and OFC ranges and male and female neonates with p=0.0303, and <0.0001, respectively. Non-significant association exists between weight ranges and OFC and male and female neonates.

Association of normal and anomalous neonates with various maternal parameters was explored. Statistically significant association was found between normal and anomalous neonates according to parental marriage type and family type (p=0.679 and p=0.6797), respectively. Cousin marriages were prevalent in parents of normal as well as anomalous neonates, 57.02% and 63.64% respectively which was higher than studied by Yaqoob et al. (1993) 45%. Majority of anomalous neonates had parental consanguinity (63.64%) which showed that consanguinity was the major risk factor for birth defects in Pakistan which was also showed by Stolenberg et al. (1997). Non-significant association exists between normal and anomalous neonates according to blood groups. Blood group B^+ was found to be more prevalent among mothers of both normal and anomalous neonates 3.05% in case of normal and 33.33% in case of anomalous neonates.

Maximum neonates were born alive 90.91%, while stillbirth and dead neonates were observed to be which 4.55% was. Proportion of death in male neonates was more 4.55% compared to female 2.77%.

According to current study CM were more prevalent among males 59.09%, compared to female neonates 38.64% which is consistent with Karbasi, (2009) (2.86% male and 2.68% female), Golalipour et al. (2005) (1.19% in males and 0.76% in females).

Statistically significant association was found between gender of neonates and their outcome (alive and dead). Within the dead neonates, majority were males 4.55%, females and unknown were 2.27% each (p=0.0059).

CM has been considered as one of the major childhood health problem, 66% of them had no recognizable etiology and most of them have multifactorial inheritance (Haris and James, 1997; Botto et al., 2001). CM appeared as important problems contributing to prenatal mortality and morbidity. All the anomalies were categorized into seven groups, musculoskeletal malformations, CNS defects, kidney problem, syndromic cases, orofacial, GIT and other minor anomalies. In the present study, musculoskeletal malformations consistent with Golalipour et al., (2005) were found to be more prevalent, 29.55%, which is much higher than proposed by Hasan et at., (2010) Shamim et al., (2010) and Tomatir et al, (2009) that was 4.59%, 3.4% and 14%, respectively, whereas prevalence per 1,000 neonates was calculated to be 12.07/1,000 and CI 0.13956-0.34032. These include skeletal dysplasia, dislocated knee, telepes, polydactyly, syndactyly, and malformed fingers and so on. This was different from Chaudhry (2011) and Anjum (2012), 18% and 26% respectively and was second most prevalent CM according to their studies. CNS disorders included meningocoel, meningomyocoel, hydrocephaly, microcephaly and spina bifida. CNS disorders was second most prevalent consistent with Golalipour et al., (2005) disorders in the present study 20.45%,which was consistent with that proposed by Hasan et al, (2010) 21.4%, higher than proposed by Tomair et al., (2009) 14%, Sania et al., (2008) 13.90/1,000 deliveries 12.07/1,000 prevalence and CI was 0.13956-0.34032. Of these malformations, meningocoel and hydrocephaly which were consistent with Karbasi et al., (2009) were common, both were 4.55%. Neural tube defects (NTDs) can be overcome by the intake of

folic acid supplements before conception or after conception, NTDs increases with advance maternal age (Sania et al., 2008). Kidney diseases were third most common anomaly in the present study, 15.91%, and 6.30/1,000. And CI was 0.11500-0.20496. Multicystic dysplastic kidney disorder was more prevalent among kidney disorders, 6.82%. Syndromic cases included Down syndrome, syndromic cases and syndromic including other anomalies. These were 11.36%, (these were higher than studied by Hasan et al. (2010) 5.61%), 4.64/1,000 prevalence and CI was 0.07396-0.15438. Orofacial diseases included cleft palate, malformed ears, and yellowish discoloration of skin. These were 6.82%, 2.79/1,000 prevalence and CI was 0.03489-0.08508. GIT disorders were 2.27%, which were lower than studied by Hasan et al. (2010) 4.59%, 0.93/1,000 prevalence, CI was 0.01163-0.02836. Other disorders include minor anomalies. These were 13.64%, 5.57/1,000 prevalence and CI was 0.06978-0.17016. Other CM malformations were 13.64%, which were lower than studied by Hasan et al. (2010) 23.4%. Prevalence per thousand was 5.57/1,000 and CI 0.06978-0.17016. Overall prevalence of CM was 40.66/1,000 which was higher than proposed by Fida et al. (2007) 27.48/1,000

The difference in the type of CM and their prevalence and proportion in various countries and in different areas of same country may not be due to genetic background but also due to geographic, socioeconomic and nutrition differences (Karbasi et al., 2009).

Infectious diseases such as sepsis, pneumonia, meconium, respiratory distress syndrome, lethargy, IUGR (intrauterine growth resistance), tachypenia, hepatitis, diarrhea, preterm births, complications of asphyxia and several others may be responsible for most of mortalities and morbidities in the neonatal period. Prematurity has been considered as main cause of neonatal

mortality and morbidity in low income countries like Pakistan. Frequency of various morbidities can be calculated. Preterm/ low birth weight was found to be more frequent, i.e. 17.02%, (prevalence was 14.86/1,000), meconic aspiration/ meconium were second most frequent in the current study and were 15.96%, (prevalence 13.98/1,000), respiratory distress were 12.77%, (prevalence was 11.14/1,000), tachypenic were 11.70%, (prevalence 10.21/1,000), lethargic were 6.38%, (prevalence 5.57/1,000), IUGR were 4.26%, (prevalence 3.71/1,000), birth asphyxia and sepsis were 3.19% each, and (prevalence 2.79/1,000) caput succedaneum, hepatitis, and cyanosis were 2.13% each, and (prevalence 1.86/1,000), and fever, pneumonia and various other morbidities were also observed in this study.

CM were found to be more prevalent in primigravida mothers compared to multigravida mother which were 38.64% on the whole 42.31% in case of male neonates and 35.29% in case of females neonates. These findings were also observed by Chaudhry, (2011) and 34% was in the study of Anjum, (2012). Significant association of maternal age and parity was observed in the present study and majority of mothers were primipara and were in the age range <25 and were 72.22%.

Neonatal weight ranges were compared with various maternal parameters, which included family type, parental consanguinity, parental residence, maternal age intervals. Statistically significant association existed between parental residence and neonates weight range ($p<0.0001$). Non-significant association existed between neonate's length, weight and OFC with respect to geographic range and maternal age.

Pre-eclampsia, a systemic disease of the later stages of pregnancy that affects about 5 - 7% of all pregnancies and can be defined as the onset of proteinuric hypertension after mid-pregnancy; and is the most common, yet least understood disorder of pregnancy (Ziael et al., 2008). Blood pressure rises and pre-eclampsia occur in the late second or third trimesters and gestational outcome is hardly affected (Iihan et al., 2002). Significant association existed between pregnancy outcome and neonates born to normal mothers and that born to mothers with PIH. High proportion of IUDs were observed in case of mothers with PIH compared to normal neonates in which 1.75% were IUDs, it had been observed that preeclampsia is a risk factor associated with IUD and neonatal mortality. Neonatal mortality rate in case of preeclampsia was also significantly higher (4.04%), compared to mortality rate in neonates born to normal mothers (0.82%). There was 2.56 fold increased risk of intrauterine fetal death Liu et al., (2008). This study showed a non-significant association between maternal age and neonates born to mothers without PIH and neonates born to mothers with PIH, which is consistent with Chappell et al., (2012) and Sibai et al., (1998), they found no association between maternal age and severity of preeclampsia, whereas US nationwide study suggested that risk of preeclampsia increases by 30% for every one year increase in age past 34 (Saftlas et al., 1990). Significant association of neonate's weight ranges, length ranges and OFC ranges with maternal PIH. Majority of neonates born to mother without preeclampsia had length, in the range, 46-50.9, (mean 48.23±1.22 in case of female neonates and 48.46±1.23 in case of male neonates), weight in the range 2.6-3.5 mean weight (2.98±0.27 in case of female neonates and 3.00±0.26 in case of male neonates), and OFC in the range 29.6-34.5, (mean OFC 33.06±1.11 in case of female neonates and 33.41±0.94). Majority of neonates born to mothers with PIH had length in the range 46-50.9, mean length was

48.41±1.29 and 47.86±1.43 female and male neonates respectively, weight in the range 1.6-2.5 and mean weight was 2.10±0.31 in case of female neonates which showed that majority of female neonates born to mothers with preeclampsia had weight less than normal weight that is 2500 and in case of male neonates range was 2.6-3.5 and mean weight was 2.97±0.20.

The difference in results can be attributed to differences in period of study, area of study, time duration of study and study design. As current study was conducted at PIMS which is a large tertiary care unit and people of multiple origin, multiple areas and multiple linguistic, multiple caste and multiple ethnicity reaches the PIMS so perhaps this is the reason for the difference in observations from this region and from various other regions within same country and from different countries.

Study showed maternal and child health conditions. Child health conditions included CM (musculoskeletal, CNS, urogenitory, GIT, orofacial, syndromic etc.), and morbidities (preterm deliveries, poor APGAR, IUGR, respiratory distress, fever, jaundice, asphyxia, sepsis etc). Maternal health conditions included anemia, hypertension (PIH, superimposed preeclampsia) which leads to premature birth, IUDs or neonatal death, gestational diabetes, poor nutrition leads to NTD due to diet deficient in folic acid and various other nutrients important for normal fetal development. Socio-economic burden also leads to hypertensive disorders which in term leads to severe pregnancy outcome, followed by neonatal mortality or morbidity.

So special attention should be payed and various steps should be taken in order to improve maternal and neonatal health in public as well as private sectors and to reduce maternal and neonatal health related issues. This includes mutual cooperation from government, NGOs, medical staff, genetic counselors and researchers.

Government should step forward for creating awareness among mothers of low socio-economic status about maternal and neonatal health and improving health and hygiene. Non-government organization should also take part in improving maternal and neonatal health. Medical staff should also pay attention in maintaining proper hygiene in labor room, gynecology ward and nursery so that neonates don't acquire infections due to unhygienic conditions. In case of congenital malformations, genetic counseling should be given to mothers for whom there is need for proper training of genetic counselors and researchers so that burden of CM could be reduced and rate of neonatal mortality and morbidity could be lowered.

4.1 Recommendations and future perspectives

For improving maternal and neonatal health and reducing severe pregnancy outcome, following steps should be taken.

- Government should provide sufficient funds for betterment of maternal and neonatal health, and for creating awareness among illiterate peoples and people from low socioeconomic class about importance of maternal health.
- There should be sufficient genetic counseling centers to overcome the burden of congenital malformations from society.
- Government should pay attention on the training of genetic counselors and researchers for improving maternal and neonatal health.
- Medical staff should also take part in raising maternal and neonatal health by guiding mothers during their visits for routine checkup.
- In hospital proper hygiene should be maintained particularly in labor room, operation theatre, gynecological ward so that mothers and newborns do not acquire infections.
- There should be sufficient facilities for the treatment of congenital malformations.

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Maternity and Pregnancy Record

Date_____ Location: PIMS Islamabad / _____ Proforma No. _____

A: Personal data

Name_____ Father name _____
City of residence Married _____ Ph. / Cell: _____
Address _____

No.	Parameter	Subject / Mother	No.	Spouse / Father
A11	Age		**A21**	
A12	Blood group		**A22**	
A13	Caste (Major)		**A23**	
A14	Caste (Minor)		**A24**	
A15	Mother Tongue		**A25**	
A16	Origin / birth place		**A26**	
A17	Rural / Urban		**A27**	
A18	Education		**A28**	
A19	Occupation		**A29**	
A20	Any disease (Congenital / acquired)		**A30**	

B: Consanguinity and Marriage Record

B1. Subject's marriage record

First Cousin:	**M1**	Double first cousin	**M6**
• Brother's children	**M2**	First cousin once removed	**M7**
• Sister's children	**M3**	Second cousin	**M8**
• Brother's on & sister daughter	**M4**	Second cousin once removed	**M9**
• Brother's daughter & sister son	**M5**	Distantly related (*Bradari*)	**M10**
		Non-related	**M11**

Marriage year:_____

Family type:

Single: **F1** Nuclear **F2** Grand parent & one couple **F3** More than one couple **F4**

Extended family **F5**

B2: Subject's Parental Relationship

First Cousin:	**P1**	Double first cousin	**P6**
• Brother's children	**P2**	First cousin once removed	**P7**
• Sister's children	**P3**	Second cousin	**P8**
• Brother's on & sister daughter	**P4**	Second cousin once removed	**P9**
• Brother's daughter & sister son	**P5**	Distantly related (*Bradari*)	**P10**
		Non-related	**P11**

C: Pregnancy / reproductive record

Gap between marriage and 1st pregnancy ____

Preg. No.	Year	S	D	Pregnancy outcome	Mode of delivery	Duration of pregnancy	Reason	Blood Grp.	Pesticides/ Fertilizers/ Smoking	Remarks
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

D: Current pregnancy record

	Date / 1st observation	Date / 2nd observation
Blood urea (10-50 mg/dl)		
Creatinin (0.4-1.3 mg/dl)		
Blood sugar (random) 80-160 mg/dl		
Uric acid 2-6		
Hb		

E: Medical Record of subject – family history

History of any disease / defect

RECORD OF BABY

Date_____ Location_____ S. no_____

Sex: _____

Mother's Name: _____

Father's Name: _____

Date Of Delivery: _____

Time Of Delivery: _____

Length	Weight	OFC	APGAR score	Bgrp	Ear lobe		Diagnosis
					M	B	

D: Current pregnancy record

Date	Gestational Period	Bp	Pulse	Temp	Height	Weight		
						Date	Wk	Kg

Dates	**Renal Function Test(RFT)**		Blood sugar (random) 80-160 mg/dl	**Liver Function Test(LFT)**			
	Blood urea (10-50 mg/dl)	Creatinin (0.4-1.3 mg/dl)		Bilirubin	SGPT	Alkaline Phosphatase	SGOT